1.0 INTRODUCTION

This report presents the results of the remedial investigation (RI) for the Portland Harbor Superfund Site conducted by the Lower Willamette Group (LWG). Portland Harbor encompasses the downstream portion of the Lower Willamette River (LWR; Figure 1-1) and has served as the City of Portland's major industrial corridor since the mid 1800's[1]. The study area for the RI extends from river mile (RM) 1.9 [upriver end of the Port of Portland's Terminal 5] to RM 11.8 [near the Broadway Bridge] and data collection for the RI report extends from RM 0.8 to RM 26.4 [above Willamette Falls near Oregon City] (Map 1-1).

Portland Harbor was evaluated and proposed for inclusion on the National Priorities List (NPL) pursuant to Section 105 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, or Superfund), 42 U.S.C. §9605, by EPA and formally listed as a Superfund Site in December 2000.

This remedial investigation report evaluates the environmental data collected and compiled by the ~~Lower Willamette Group (~~LWG~~)~~ since the inception of the Portland Harbor Remedial Investigation and Feasibility Study (RI/FS) in 2001[2]. ~~Portland Harbor, which encompasses the downstream portion of the Willamette River in Portland, Oregon, was designated as a Superfund site in 2000 under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).~~

The LWG is performing the RI/FS for the Portland Harbor Superfund Site (Site) pursuant to a U.S. Environmental Protection Agency (EPA) Administrative Settlement Agreement and Order on Consent for Remedial Investigation/Feasibility Study (AOC; EPA 2001a, 2003b, 2006a). Oversight of the Portland Harbor RI and FS is being provided by EPA with support from Oregon Department of Environmental Quality (DEQ). ~~As provided in the Statement of Work (SOW) to the AOC, the objectives of the Portland Harbor RI/FS are as follows:~~

- ~~Investigate the nature and extent of contamination for the Study Area[3]~~
- ~~Identify sources of contamination that contribute, or have contributed, to unacceptable risk in Study Area[4]~~

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[1] In this RI Report, the term "Portland Harbor" means the portion of the Willamette River containing the federal navigation channel, from RM 0 to RM 11.6. The terms "Lower Willamette River" and "LWR" mean the portion of the Willamette River from its confluence with the Columbia River to Willamette Falls, or RM 0 to approximately RM 26.5.

[2] Upland source control efforts, including site-specific upland source control studies and implementation of source control measures, are performed under the oversight of the Oregon Department of Environmental Quality and are not within the scope of the AOC and SOW for the in-water portion of the Site.

[3] ~~Defined as the in-water portion below or equal to +13 ft North American Vertical Datum (NAVD) from river mile 1.9 to 11.8.~~

~~This draft document has been provided to EPA at EPA's request to facilitate EPA's comment process on the document in order for LWG to finalize the RI. The comments or changes (including redlines) on this document may not reflect LWG positions or the final resolution of the EPA comments.~~

- ~~Assess potential risk to human health and the environment~~

- ~~Develop and evaluate potential remedial alternatives to reduce risks to acceptable levels~~

- ~~Recommend a preferred alternative for cleanup.~~

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~~This RI Report addresses the first three objectives and includes the human health and ecological baseline risk assessments as appendices. The final two objectives will be addressed in the FS. The Final RI Report will capture any preliminary or incomplete information from the risk assessments that has changed pursuant to finalization of these documents.~~

~~Portland Harbor has been the focus of numerous environmental investigations completed by the LWG and various other governmental and private entities. Major LWG data collection efforts occurred during three sampling rounds to characterize the physical system of the lower Willamette River (LWR) and to assess the nature and extent of contamination in sediment, surface water, transition zone water (TZW)[5], stormwater, and biota. Media-specific investigations performed in Round 1 (summer 2002 to spring 2004) and Round 2 (fall 2004 to spring 2006) were previously documented in the *Comprehensive Round 2 Site Characterization Summary and Data Gaps Analysis Report* (Round 2 Report; Integral et al. 2007), which was submitted to the EPA on February 21, 2007. Round 3 sampling activities took place during multiple field efforts in the winter of 2006, the summer/fall/winter of 2007, and February 2008. Data collected during these efforts supplemented the data collected in previous sampling rounds and closed data gaps identified by EPA and LWG.~~

The content and organization of this RI report adhere to CERCLA's *Guidance Document for Conducting Remedial Investigations and Feasibility Studies under CERCLA, Interim Final* (EPA 1988). ~~The required content of this RI Report is specified in Section 7.8.2 of the SOW:~~

~~This report shall summarize results of field activities to characterize the Site, sources of contamination, nature and extent of contamination, and the fate and transport of contaminants. Respondents will refer to the RI/FS Guidance for an outline of the report format and contents. Following comment by EPA, Respondents will prepare a final RI Report that satisfactorily addresses EPA comments.~~

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In accordance with these requirements, this report assembles data collected by the LWG and others, characterizes the physical characteristics and nature and extent of contamination in the Study Area ~~(described below in Section 1.2)~~ based on those data, identifies sources of contaminants to the Study Area, provides an analysis of the fate and transport of contaminants,

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[4] ~~Upland source control efforts, including site-specific upland source control studies and implementation of source control measures, are performed under the oversight of the Oregon Department of Environmental Quality and are not within the scope of the AOC and SOW for the in-water portion of the Site.~~

[5] ~~Transition zone water is the interval where both groundwater and surface water comprise some percentage of the water occupying pore space in the sediments.~~

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discusses background contaminant concentrations, presents the baseline human health and ecological risk assessments, and provides a revised conceptual site model (CSM). Information collected during the RI will be used to help identify areas requiring cleanup. The FS report will analyze and compare alternatives or approaches to remediate those areas that need cleanup to reduce or eliminate risks.~~The identification of areas of potential concern (AOPCs) and preliminary remediation goals (PRGs) for those AOPCs will be addressed during the FS process, and are not discussed in this RI Report.~~

~~The revised CSM expands upon the preliminary CSM previously presented in the Programmatic Work Plan (Integral et al. 2004), and updated in the CSM Update (Integral and GSI 2005a,b,c) and the Round 2 Report. Unlike the AOPC-specific CSMs presented in Section 11 of the Round 2 Report, the scope of the revised CSM presented in this RI Report is site-wide and includes a cross-media conceptual understanding of sources, contaminant distribution, loading, fate and transport, and exposure pathways for human and ecological receptors for select contaminants of concern (COCs).~~[6]

~~1.1 RI/FS OVERVIEW AND OBJECTIVES~~

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~~The Programmatic Work Plan presented a generalized road map of the RI/FS process for the Portland Harbor Superfund Site. The process is multifaceted and iterative, with specific sampling events, technical memoranda, and decision points made during various phases that inform the RI and direct future FS work. The RI and FS are conducted concurrently, and data collected during the RI phase are used to develop and evaluate remedial alternatives in the FS phase. The ultimate goal of the RI is to collect sufficient data to adequately characterize the Site so that EPA can select a remedy that is protective of human and ecological receptors. The ultimate goal of the FS is to ensure that appropriate remedial alternatives are developed and evaluated in accordance with CERCLA guidance to allow the selection of the most efficient remedies for cleanup that balance effectiveness, protectiveness, cost, compliance with Applicable or Relevant and Appropriate Requirements (ARARs), and public acceptance.~~

~~The RI was conducted consistent with EPA (1988) guidance (page 1-3, 2nd paragraph):~~

~~The objective of the RI/FS process is not the unobtainable goal of removing *all* uncertainty, but rather to gather information sufficient to support an informed risk management decision regarding which remedy appears to be most appropriate for a given site. The appropriate level of analysis to meet this objective can only be reached through constant strategic thinking and careful planning concerning the essential data needed to reach a remedy selection decision. As hypotheses are tested and either rejected or confirmed, adjustments or choices as to the appropriate course for further investigations and analyses are required. These choices, like the remedy selection itself, involve the balancing of a wide variety of factors and the exercise of best professional judgment.~~

[6] ~~Prior deliverables and some of the tables and figures attached to this document may use the term "chemical of concern," which has the same meaning as "contaminant of concern" and refers to "contaminants" as defined in 42 USC 9601(33).~~

Specific objectives of the RI, which conform to the CERCLA RI/FS guidance document (EPA 1988) and the SOW, include the following:

- Investigate and describe the Site's physical setting, including land use, hydrology, hydrogeology, river and sediment dynamics, aquatic and wildlife habitat, and human use
- Identify major sources of historical and ongoing chemical contamination and the status of source control activities
- Describe the nature and extent of indicator chemicals (ICs), vertically and laterally, that may pose risk for both harbor-wide and localized areas of contamination[7]
- Evaluate the loading, fate, and transport of ICs using available empirical information and model results
- Define the concentrations and statistical characteristics of ICs in appropriate upstream reference locations (i.e., background) for use in risk characterization, PRG development, and remedial alternatives evaluation during the FS
- Assess human and ecological risk under baseline conditions and identify COCs that may pose unacceptable risk
- Develop a revised site-wide CSM for select ICs that describes the cross-media understanding of contaminant distribution, sources, loading, fate, transport, and exposure pathways for human and ecological receptors at the Site.

Ultimately, the primary information needed to make risk management decisions includes the following:

1. Identification of the receptors, exposure scenarios, and contaminants that are associated with potentially unacceptable risk from exposure to in-water media

For the above, identification of the exposure pathways (including media) and, to the extent practicable, locations that contribute most to a finding of unacceptable risk

1. For the receptors/pathways/contaminants identified in items "1" and "2" above, determination of whether the most important sources of contaminants to the river are ongoing or historical (not current releases), so that risk management actions can be taken to reduce exposures.

For in-water sources, actions may include active cleanup, natural recovery, or other management options for contaminated sediments in the river. The RI/FS must also identify

[7] Although chemicals in addition to those on the IC list are present within the Study Area and may pose risk to human health and the environment, the IC list was generated, in consultation with EPA (as documented in Appendix A5, Attachments A4, A7, A9, and A11), based on the preliminary COCs that emerged from the Round 2 risk screening and preliminary risk evaluation process and consideration of the following non-risk-based factors: (1) detection frequency; (2) suitability for cross-media comparisons in this RI Report; (3) representativeness of a given IC for a suite of related chemicals; and (4) specific EPA requests to include certain additional chemicals as ICs. See Section 5.0 for additional discussion.

~~potential sources that are not in the river, or are in the river upstream of the Study Area, but that are important ongoing sources of contamination to sediments and surface water, and therefore, may require management to address unacceptable risks to humans and biota associated with the Study Area. Management of these sources will be overseen by the Oregon Department of Environmental Quality (DEQ).~~

~~1.2 AREA OF STUDY~~

~~In accordance with the AOC, the RI/FS initially focused on the stretch of the LWR from river mile (RM) 3.5 to 9.2 and adjacent areas logically associated with an evaluation of the in-water portion of this stretch of the river. The SOW and the Programmatic Work Plan refer to that initial study area as the "ISA." The boundaries of the ISA were based on the results of a site investigation undertaken by EPA and DEQ in 1997 (described further in Section 1.3).~~

~~During development of the Programmatic Work Plan, EPA required the LWG to broaden the investigation upstream and downstream to include areas of the river extending from approximately RM 1.9 to 11; this expanded area was termed the "Study Area." Based upon its review of the Round 2 Report, EPA further expanded the Study Area to include RM 1.9 to 11.8[8] (Map 1.2-1). The ISA and the subsequent Study Areas do not define the Portland Harbor Superfund Site, the boundaries of which will be determined by EPA upon issuance of a Record of Decision (ROD).~~

~~1.3~~1.1 SITE BACKGROUND

1.1.1 Site Description

The Willamette River originates within Oregon in the Cascade Mountain Range and flows approximately 187 miles north to its confluence with the Columbia River. The Lower Reach of the Willamette River from River Mile (RM) 0 to approximately RM 26.5 is a wide, shallow, slow moving segment that is tidally influenced with tidal reversals occurring during low flow periods as far upstream as RM 15. The river segment between RM 3 and RM 10 is the primary depositional area of the Willamette River system. The Lower Reach has been extensively dredged to maintain a 40-foot deep navigation channel from RM 0 to RM 11.6. This segment of the Lower Reach contains a highly industrialized area known as Portland Harbor, which contains a multitude of facilities and both private and municipal outfalls.

Portland Harbor is located along an 11.6-mile dredged reach of the Lower Willamette River (LWR) in Portland, Oregon (Figure 1-1, Map 1-1). While the harbor area is heavily industrialized, it occurs within a region characterized by commercial, residential, recreational, and agricultural uses. Land use along the Lower Willamette

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[8] ~~As part of the RI, the LWG also sampled contiguous areas adjacent to the Study Area downstream to RM 0.8, in the upstream portion of the Multnomah Channel, and upstream to RM 12.2. This sampling was conducted to support the Site boundary definition and assess potential contaminant migration in these adjacent areas.~~

River in the harbor includes marine terminals, manufacturing, and other commercial operations, as well as public facilities, parks, and open spaces. Map 1-2 illustrates land use zoning within the Lower Willamette River as well as waterfront land ownership.

1.1.2 Site History

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The Willamette River is the 12th largest river in the United States and is one of 14 American Heritage Rivers in the country. During its 99-mile course, which ends by emptying into the Columbia River, it drains 11.7 percent of the state of Oregon. ~~Today, the Willamette River is noticeably different from the river used by the Native Americans in the 18th century. Historically, the Willamette was wider, had more sand bars and shoals, and fluctuated greatly in volume. In contrast, the main river now has been redirected and channelized, several lakes and wetlands in the lower floodplain have been filled, and agricultural lands converted to urban or industrial areas. The end result is a river that is deeper and narrower than it was historically with higher banks that prevent the river from expanding during high-flow events. Further, the installation of a series of dams moderated fluctuations of flow. Little, if any, original shoreline or river bottom exists that has not been modified by the above actions, or as a result of them. Some riverbank areas and adjacent parcels have been abandoned and allowed to revegetate, and beaches have formed along some modified shorelines due to relatively natural processes.~~

~~From as early as the 1840s, the development of Portland has been connected to the development of the Willamette. Portland Harbor is a heavily industrialized reach of the LWR, located immediately downstream of downtown Portland and extending almost to the confluence with the Columbia River. Since the late 1800s, the harbor has been extensively modified by wetland draining, channelization, and dredging for creation and maintenance of the navigation channel and ship berthing areas. The harbor has been the site of numerous manufacturing, shipbuilding, petroleum storage and distribution, metals salvaging, and electrical power generation activities.~~

In 1891, the Oregon State Legislature created the Port of Portland. By 1930, following a period of railroad and riverfront development, shipping tonnage for the Port increased to 4.1 million tons. The Port of Portland is now the largest wheat exporting port in the country ~~(Port of Portland 2011)~~. Cargo from more than 40 U.S. states passes through Portland as part of the approximately $15 billion in goods that travel the Columbia River system. As Oregon's major port and population center, the LWR sees a great variety of uses. For example, shipping, industrial, fishing, recreational, natural resource, and other interest groups all use the LWR.

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Since the late 1800s, the Portland Harbor section of the Lower Willamette River has been extensively modified to accommodate a vigorous shipping industry. Modifications include redirection and channelization of the main river, draining seasonal and permanent wetlands in the lower floodplain, and relatively frequent dredging to maintain the navigation channel. Constructed structures, such as wharfs,

piers, floating docks, and pilings, are especially common in the Portland Harbor where urbanization and industrialization are most prevalent. These structures are built largely to accommodate or support shipping traffic within the river and to stabilize the riverbanks for urban development. Riprap is the most common bank-stabilization measure. However, upland bulkheads and rubble piles are also used to stabilize the banks. Seawalls are used to control periodic flooding as most of the original wetlands bordering the Willamette in the Portland Harbor area have been filled. Constructed structures are clearly visible in the aerial photos provided in Maps 1-3a-n.

Today, the Willamette River is noticeably different from the river prior to industrial development that commenced in the mid to late 18th century. Historically, the Willamette was wider, had more sand bars and shoals, and fluctuated greatly in volume. In contrast, the main river now has been redirected and channelized, several lakes and wetlands in the lower floodplain have been filled and agricultural lands converted to urban or industrial areas. The end result is a river that is deeper and narrower than it was historically with higher banks that prevent the river from expanding during high-flow events. Further, the installation of a series of dams moderate fluctuations of flow in the LWR. Little, if any, original shoreline or river bottom exists that has not been modified by the above actions, or as a result of them. Some riverbank areas and adjacent parcels have been abandoned and allowed to revegetate, and beaches have formed along some modified shorelines due to relatively natural processes.

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Numerous municipal and private outfalls, including storm drains and combined sewer overflows, are located along both shores of the LWR in the metropolitan area. In the early 1900s, rivers in the United States were generally used as open sewers, which was also true for the Willamette (Carter 2006). The growing city's untreated sewage, as well as process water from a variety of industries, including slaughterhouses, chemical plants, electroplaters, paper mills, and food processors, was discharged directly into the river. ~~Early 1920s studies of the Willamette's water quality found the river to be extensively polluted and described the river as "intolerable" and "ugly and filthy."~~The long history of industrial and shipping activities in the Portland Harbor, as well as agricultural, industrial, and municipal activities upstream of Portland Harbor, has contributed to chemical contamination of surface water and sediments in the LWR. Potential sources of chemical releases to the river are described in Section 4 of this report.

Development of the river has resulted in major modifications to the ecological function of the LWR. However, a number of species of invertebrates, fishes, birds, amphibians, and mammals, including some protected by the Endangered Species Act (ESA), use habitats that occur within and along the river. The river is also an important pathway for migration of anadromous fishes, such as salmon and lamprey. Various recreational fisheries, including salmon, bass, sturgeon, crayfish, and others, use the LWR. A detailed description of ecological communities in Portland Harbor is presented in the Baseline Ecological Risk Assessment discussion in Section 7 and Appendix G of this report.

1.1.3 Navigational Channel Authorization History

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A federal navigation channel, with an authorized depth of -40 feet, extends from the confluence of the LWR with the Columbia River to RM 11.6. Container and other commercial vessels regularly transit the river. Certain parts of the river require periodic maintenance dredging to keep the navigation channel at its authorized depth. In addition, the Port of Portland and other private entities periodically perform maintenance dredging to support access to dock and wharf facilities. Dredging activity has greatly altered the physical and ecological environment of the river in Portland Harbor.

The LWR federal navigation project was first authorized in 1878 to deepen and maintain parts of the Columbia River and LWR with a 20-foot minimum depth. The channel for both rivers has been deepened at various intervals since that time. The navigation depth for both rivers was increased to 25 feet in 1899 and to 30 feet in 1912. Between 1930 and 1935, the navigation channel depth was again increased to 35 feet, and in 1962 the authorized depth was increased to 40 feet. The current project authorization, as modified by Congress in 1962, encompasses 11.6 miles of the Willamette River below Portland and 103.5 miles of the Columbia River below Vancouver, Washington. Work on the authorized 40-foot deep channel from Portland and Vancouver to the Pacific was completed in 1976. The Willamette River channel, from the Broadway Bridge (RM 11.6) to the mouth (RM 0), varies in width from 600 to 1,900 feet.

1.1.4 Previous Investigations

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There have been numerous investigations of the Portland Harbor site dating back to the 1920's; however, most studies have been conducted from the late 1970's through the 1990's. Some investigations have been conducted on a larger scale (e.g., several river miles) while others have been conducted on a smaller scale (e.g., less than one river mile). Larger scale investigations have typically been conducted by or for federal or state agencies, such as the U.S. Army Corp of Engineers (USACE), the U.S. Geologic Survey (USGS), the Oregon Department of State Lands (DSL), the Oregon Department of Fish and Wildlife (ODFW), the Oregon Department of Environmental Quality (DEQ) Water Program, and the U.S. Environmental Protection Agency (EPA), to assess the health of the river system. Smaller scale investigations have typically been conducted by private parties for the purposes of maintenance dredging, construction and maintenance of in-river structures, or assessment of fate and transport of contamination from upland or in-water releases.

Nearly 700 documents and data sets were obtained that address conditions in the LWR. This information was used to develop an initial understanding of the physical, chemical, and biological processes at the site and to assist in the development of the conceptual site model for the Study Area. Appendix A discusses which of these data sets were included in the final RI Report.

Today, contamination enters the river (i.e., Study Area, which consists of surface water and bedded sediment) through several pathways, including stormwater, permitted industrial discharges, atmospheric deposition, riverbank erosion, groundwater, combined sewer overflows (CSOs), and incidental releases within the Study Area, and in surface water and sediment inflows from upstream.

Once in the surface water, most contaminants bind to fine-grained sediment particles. The fate and transport of these particles in the river (i.e., where particles settle out, and whether they are permanently deposited or are episodically resuspended and transported by natural or anthropogenic disturbance factors) determines the degree to which these contaminants affect ecological and human receptors and which sediment areas pose risk over time. Understanding these internal fate and transport processes is a major focus of this RI/FS.

Public and private outfalls are located on both shores of the river. These outfalls have historically discharged stormwater, municipal waste, and industrial wastewater to the harbor from numerous drainage basins that have a variety of land uses and facilities. In addition to areas adjacent to the harbor, agricultural, industrial, transportation, and residential land uses in the Willamette Basin upstream of the harbor historically and currently discharge municipal, agricultural, and industrial wastewater and stormwater directly to the Willamette River and indirectly discharge through overland, overwater, and groundwater pathways, thereby contributing to chemical contamination of sediments in the Study Area. Although private industries and municipalities within the river watershed began installing waste control systems beginning in the 1950s, the legacy of past waste management practices remains in the river bottom sediments.

In March 1997, DEQ and EPA initiated a joint study of shallow, nearshore river sediment contamination in the LWR from approximately RM 3.5 to 9.5. Sediments containing metals, polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), chlorinated pesticides, and dioxins were found throughout the harbor area (Weston 1998). Based on the concentrations of these contaminants, EPA determined in December 2000 that Portland Harbor qualified for placement on the National Priorities List (NPL) under CERCLA. In the listing, EPA and DEQ are the lead agencies for the in-water and upland portions, respectively, of the Portland Harbor Superfund Site. Both agencies coordinate their efforts through a Memorandum of Understanding (MOU) that was signed in 2001 by government stakeholders, including six tribal governments (the Confederated Tribes and Bands of the Yakama Indian Nation, the Confederated Tribes of Grande Ronde, the Confederated Tribes of Siletz Indians of Oregon, the Confederated Tribes of the Warm Springs Reservation of Oregon, the Confederated Tribes of the Umatilla Indian Reservation, and the Nez Perce tribes) and several state and federal natural resource trustees (National Oceanic and Atmospheric Administration [NOAA], Oregon Department of Fish and Wildlife [ODFW], U.S. Fish and Wildlife, and U.S. Department of Interior).

~~In September 2001, EPA and the LWG entered into the AOC to complete an RI/FS of the Portland Harbor Superfund Site. The LWG includes private property owners along the Willamette River, the Port of Portland, and the City of Portland and represents a small subset of the potentially responsible parties (PRPs) identified by EPA. The final Programmatic Work Plan was approved by EPA in June 2004. The Programmatic Work Plan provides an outline and schedule for the sampling activities performed to support the RI/FS. All field sampling activities are documented in a series of field sampling plans (FSPs), quality assurance project plans (QAPPs), health and safety plans, field sampling reports (FSRs or cruise reports), and site characterization summary reports (SCSRs). The Programmatic Work Plan also stipulated the development of technical memoranda to address certain elements of the RI, such as modeling efforts and the development of the baseline risk assessments. The entire RI/FS process has been dynamic and iterative, with the evaluation of new site data resulting in modifications to the original RI approach specified in the Work Plan.~~

~~Cleanup activities are currently underway in Portland Harbor. EPA evaluated 32 upland sites in 1982, several of which are current sources to the river, and deferred most of them to DEQ for cleanup. DEQ is presently working with upland property owners to identify and control upland sources of contamination that may be affecting river sediments through such pathways as overland runoff, bank erosion, stormwater discharge, or groundwater seepage. A total of 84 upland sites are in various phases of cleanup, ranging from agreement negotiation to source control evaluation and implementation (DEQ 2009b). Cleanup at two upland NPL sites within or adjacent to Portland Harbor (Gould and McCormick & Baxter Creosote Co. [M&B]) has been implemented, including some in-water work at M&B.~~

~~DEQ is also collaborating with the City of Portland's Bureau of Environmental Services (BES) to identify, investigate, and control contaminant discharges to shared City stormwater conveyance lines. As part of the City's 20-year combined sewer overflows abatement program, to be completed by 2011, all or a portion of the stormwater discharging through 15 City of Portland outfalls is being diverted to the wastewater treatment plant.~~

~~Early in-water removal actions have been or are being performed by three upland property owners under separate EPA orders: Port of Portland at Terminal 4 (RM 4.5), NW Natural adjacent to the former Gasco site (RM 6.2), and Arkema adjacent to its former plant (RM 7.2). These actions will probably precede any remediation that occurs as a result of the Portland Harbor RI/FS and will be coordinated with cleanup actions ordered by EPA in the Portland Harbor ROD(s).~~

~~EPA is also working with the University of Portland to conduct cleanup activities on the Triangle Park property (RM 7.4). EPA is overseeing the investigation and eventual upland cleanup.~~

~~1.4~~1.2 REPORT ORGANIZATION

~~The remaining sections of this report include the following information~~This document is organized as follows:

- **Section 1. Introduction.** This section describes the purpose of the report and presents site background information.
- **Section 2. ~~Environmental Data Sets~~Study Area Investigation.** This section summarizes the field activities associated with site characterization. ~~focuses on data quality reviews that were performed to evaluate the quality of LWG and non-LWG data and to determine their usability for various purposes in the RI/FS, Baseline Human Health Risk Assessment (BHHRA), and Baseline Ecological Risk Assessment (BERA). It summarizes the LWG investigative activities that have occurred since the Portland Harbor RI/FS began in 2001, including sediment, surface water, TZW, sediment trap, stormwater, and biota sampling, as well as physical characterizations. Historical and concurrent investigations performed by others and used in the risk evaluations are also described.~~

~~The data set introduced in Section 2 represents data collected or received between May 1, 1997 and June 2, 2008. Sections 2 through 11 of this report are based on this initial lockdown date. Between June 2, 2008 and July 19, 2010, a significant amount of sediment data was collected from the portion of the river that passes through downtown Portland. A second lockdown date of July 19, 2010 was established to capture this new data as well as other data collected from the Study Area. Data collected or received between June 8, 2008 and July 19, 2010 are presented in Appendix H. The following table summarizes the location of data associated with these two lockdown dates:~~

~~sud~~**~~Report Section~~**	**~~Data Lockdown Date~~**
~~Sections 2–11 and Associated Appendices~~	~~June 2, 2008~~
~~Appendix F: BHHRA~~	~~June 2, 2008 plus select studies: EPA fish and sediment polybrominated diphenyl ether (PBDE) data, Terminal 4 Abatement Phase I construction project data~~
~~Appendix G: BERA~~	~~June 2, 2008 plus select studies: EPA osprey egg data, EPA sediment~~

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sudReport Section	Data Lockdown Date
	PBDE data, Terminal 4 Abatement Phase I construction project data, RM 11E data
Appendix H	July 19, 2010, which includes data collected prior to June 2, 2008

In addition, map base layers were subject to lockdown dates:

Base Layer/Report Section	GIS Base Layer Lockdown Date
Highlighted Upland ECSI Sites/Sections 2-3, 5-6, 11 and Associated Appendices	2008
Highlighted Upland ECSI Sites/Sections 4 and 10	2009
Bathymetric Hillshade and Depth Change/Section 3	Historical Depiction (2001), Current Depiction (2009)
Outfalls/All Sections	2009
Dredge & Cap Areas/Detailed Core Plot Maps (Appendix D1.2) and Appendix H	2011
Dredge & Cap Areas/All Other Sections	2008

- **Section 3. Environmental SettingPhysical Characteristics of the Study Area**. This section reviews discusses the results of activities to determine physical and human characteristics and human use of the Study Area, including meteorology, geology, hydrogeology, bathymetry, sediment physical properties, habitat, current and historical land and harbor use, history of the municipal and non-municipal conveyance systems, and public access. Results from the application of the hydrodynamic sedimentation model are also discussed.

This draft document has been provided to EPA at EPA's request to facilitate EPA's comment process on the document in order for LWG to finalize the RI. The comments or changes (including redlines) on this document may not reflect LWG positions or the final resolution of the EPA comments.

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- **Section 4. Identification of Sources.** This section describes ~~general land use changes to give a historical context to the Study Area. T~~the types of known and potential contaminant sources that affect the Study Area ~~are identified~~. ~~This section augments general information on sources provided in the Programmatic Work Plan and the Round 2 Report.~~
- **Section 5. ~~In-river Distribution of Indicator Chemicals~~Extent of Contamination.** This section ~~describes the nature and extent of ICs in surface and subsurface sediment, in-river sediment traps, surface water, TZW, and biota~~presents the results of site characterization of contamination in various media within the Willamette River.
- **Section 6. ~~Loading,~~Contaminant Fate~~,~~ and Transport ~~for Select Indicator Chemicals~~.** This section uses indicator contaminants to present~~s~~ an overview of the primary known sources of contaminants to the river~~,~~; describes the processes affecting the release, transport, and fate of contaminants~~ICs~~ within the Study Area~~,~~; and presents estimates of current pathway-specific mass-loading rates ~~of select ICs~~. Historical ~~loading~~ contributions to the Study Area are~~is~~ discussed qualitatively in this section.
- **Section 7. Determination of Background Concentrations ~~for Indicator Chemicals~~.** This section provides an evaluate~~s~~ion of the concentrations and ~~statistical characteristics of ICs~~distributions of in surface water and sediment samples collected from upstream reference locations (i.e., background) for use in ~~risk characterization, PRG~~ development~~, and~~ of remedial alternatives ~~evaluation during~~in the FS. ~~Sediment trap data, surface water suspended solids, and subsurface sediment data collected from dredge borrow pits near the upstream end of the Study Area are also discussed as supporting lines of evidence for background~~.
- **Section 8. Baseline Human Health Risk Assessment ~~Summary~~.** This section provides a summary of the BHHRA conducted for this site. The BHHRA is provided ~~included~~ in Appendix F of this document.
- **Section 9. Baseline Ecological Risk Assessment ~~Summary~~.** This section provides a summary of the BERA conducted for this site. The BERA is provided ~~included~~ in Appendix G of this document.
- ~~**Section 10. RI Conceptual Site Model for Select Indicator Chemicals.** This section presents a site-wide overview of the physical setting; contaminant distribution in sediments; contamination sources; external loading and internal fate and transport mechanisms; human health risk drivers and potentially complete exposure pathways/scenarios; and ecological risk drivers and ecological receptors/exposure pathways. For selected ICs, this section also presents integrated, chemical-specific evaluations of nature and extent in abiotic and biotic media in the Study Area, and the relationships between the observed distribution in the system and known or likely historical and current sources of contamination.~~

- **Section 10~~1~~. Summary and Conclusions.** This section provides the major findings of the RI and the next steps in the RI/FS process.
- **Section 11~~2~~. References.** Citations noted in the RI are found in this section.
- **Section 12~~3~~. Glossary.** This section contains definitions of technical terms found in the RI.

Nine appendices are included with this document:

- **Appendix A. Data Sources and Site Characterization/Risk Assessment Database.** This appendix briefly summarizes the studies from which data in this RI report were obtained and includes the complete database in Access® files on compact disc. Data rules for ~~reducing~~ the site characterization/risk assessment (SCRA) database into the RI data set are provided. ~~This SCRA database in Appendix A reflects the June 2, 2008 lockdown date.~~ Further, this appendix includes the process for calculating chemical concentrations from whole-body bass and carp samples. ~~Finally, an administrative appendix that documents the decision-making process between EPA and the LWG for the RI is included~~.
- **Appendix B. DEQ September 2010 Milestone Report Table 1.** This appendix presents Table 1 from DEQ's Joint Source Control Strategy (JSCS) Milestone Report (DEQ 2010c).
- **Appendix C. Stormwater Statistics and Groundwater Characterization.** Summary statistics for stormwater collected by the LWG and other parties are included in this appendix. ~~Details of LWG's groundwater pathway assessment work, including identification of potential upland groundwater source areas and TZW investigation results, are also provided.~~
- **Appendix D. Nature and Extent of Contaminants in Biotic and Abiotic Media.** Summary statistics of the chemical and physical data for all media are provided. The appendix includes constituent concentrations used in each summed analyte group for all media. Scatter plots, histograms, and maps of contaminant distribution of ICs not included in the main report are also included in this appendix. A technical memo, Comparison of PCB Aroclor and Congener Data, is included in this appendix. The results of screening the surface water and TZW data against human-health-based criteria are also presented in this appendix..
- **Appendix E. Loading, Fate, and Transport Supporting Information and Calculations.** This appendix provides the analyses used to develop loading estimates for upstream surface water, stormwater, permitted point source discharges, atmospheric deposition, groundwater plumes, and advection through sediments.
- **Appendix F. Baseline Human Health Risk Assessment.** This appendix provides the ~~complete~~final ~~-~~BHHRA conducted for this site.

Commented [A2]: What about BHHRA and BERA data sets?

- **Appendix G. Baseline Ecological Risk Assessment.** This appendix provides the ~~complete~~final ~~-~~BERA conducted for this site.
- **Appendix H. Updated RI Data Set: Distribution of Indicator Chemicals in the Upper Study Area and Upstream and Downstream Areas.** This appendix updates the presentation of the Downtown Reach and the area off RM 11 using an updated RI data set. Data sets collected or received between June 2, 2008 (the Draft RI Report data lockdown date) and July 19, 2010 (the Final RI Report data lockdown date) are included in the updated database. The updated RI data set is provided in Access® on compact disc in an attachment to this appendix. Other attachments to this appendix include the following:
  - Summary statistics of the chemical and physical data for sediment and sediment trap data
  - Summaries of the new studies provided in the updated RI data set
  - The complete data report, *Contaminant Concentrations in Osprey (Pandion haliaetus) Eggs from Portland Harbor and Surrounding Areas: Data Summary Report* prepared by the U.S. Fish and Wildlife Service and Associates Environmental Consulting, LLC
  - A technical memo, Monitored Natural Recovery Area Radioisotope Evaluation in the upper Study Area.
- **Appendix H~~I~~. Interactive Map Application of Section 10 Panels.** This appendix provides an interactive map application of the three-section panel analyte-specific series included in Section 10 that present cross-media contaminant distributions and available source information for each of the 13 CSM contaminants. The panels show the entire Study Area, upland site property boundaries, outfall locations, historical industries, and river mile markers, and these layers can be turned on and off to display different combinations of information (e.g., subsurface sediment and biota PCB distributions).

Commented [A3]: This should be combined with Appendix A.

Commented [A4]: This is not what we agreed to – they were to present all COCs. This language will need to be updated. I also think this can be used in Section 5.0. Will need to have discussions when Section 5.0 is reviewed.